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Yellow-breasted Chat and Gray Catbird Productivity in a Fragmented Western Riparian System

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ABSTRACT.—We studied the effects of habitat fragmentation on productivity of Yellow-breasted Chat (*Icteria virens*) and Gray Catbird (*Dumetella carolinensis*) in southern British Columbia in a western riparian ecosystem. Nesting dates were later in isolated habitat patches than in continuous habitat patches for both species. We found no direct evidence that habitat fragmentation decreased productivity in either species. Average fecundity did not significantly differ between continuous (2.54 fledglings for Gray Catbird; 1.78 and 1.67 fledglings for Yellow-breasted Chat in 2002 and 2003, respectively) and isolated sites (1.33 fledglings for Gray Catbird; 1.78 and 0.87 fledglings for Yellow-breasted Chat in 2002 and 2003, respectively). Territory size, as measured by mapping perch locations for breeding adults, was smaller for Yellow-breasted Chats breeding in the Okanagan Valley (0.25 ha) than for chats in mid and high-density southern populations. However, overall fecundity and nest success were similar to more southerly populations. These results suggest that both species can persist in a relatively fragmented ecosystem. *Received 30 June 2005. Accepted 17 October 2006.*

Riparian areas provide critical breeding and stopover habitat for a large diversity of birds. Despite its importance to avian communities, there has been considerable loss of riparian habitat throughout North America (Croonquist and Brooks 1993). Thus, there is a need to understand avian population trends in relation to habitat alteration. Several studies have documented a decrease in productivity and an increase in brood parasitism in association with increased habitat fragmentation (Wilcove and Robinson 1990, Donovan et al. 1995). Under some conditions, habitat fragmentation may lead to a decline in population numbers (Sherry and Holmes 1992, 1993).

Robinson et al. (1995, 2000) documented a relationship between lower productivity and increased habitat fragmentation in eastern forests. Western riparian ecosystems are fragmented by nature because of frequent flooding, ephemeral water sources, and mountainous topography (Hejl 1992, 1994; Ohmart 1994). The few studies that have examined the effects of fragmentation in western landscapes have generally found a less direct relationship between habitat fragmentation and productivity (Tewksbury et al. 1998).

We tested the hypothesis that fragmented habitat negatively affects reproductive success of Yellow-breasted Chat (*Icteria virens*) and Gray Catbird (*Dumetella carolinensis*) in western riparian habitats throughout the Okanagan Valley, British Columbia, Canada. Both species predominantly use wild rose (*Rosa* spp.) as a nesting substrate and forage in close proximity to one another (Cannings et al. 1987; TCM, pers. obs.). Yellow-breasted Chat and Gray Catbird nests are commonly within 5 m of one another. The Okanagan Valley represents the northwest fringe of the Yellow-breasted Chat's breeding range (Eckerle and Thompson 2001), while Gray Catbird populations extend farther north into northern British Columbia (Cimprich and Moore 1995). We compared reproductive parameters for Yellow-breasted Chat with more southerly populations.

METHODS

Aerial photographs of riparian habitat in the Okanagan Valley, British Columbia and Yellow-breasted Chat surveys in 2001 were used to categorize four large riparian patches (15–70 ha) as continuous and five smaller patches as isolated (<2 ha). Continuous sites were tracts of unbroken riparian habitat that con-

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tained >15 ha of unbroken habitat with flowing water. Isolated sites were small fragmented patches of riparian habitat, primarily along roadsides and drainage ditches. Isolated sites were separated from other riparian habitats by >5 km and had ephemeral water sources. All sites were <600 m in elevation and were between the International Boundary (49° 02′ N, 119° 27′ W) and the city of Penticton (49° 30′ N, 119° 35′ W). All study sites were used by chats in 2002. Three of the isolated sites and one continuous site were unused by Yellow-breasted Chats in 2003. Gray Catbird nests were monitored at the same sites as Yellow-breasted Chats in 2003. All sites were monitored for breeding activity between 13 May and 15 August 2002 and 2003.

Surveys for breeding Yellow-breasted Chats and Gray Catbirds were conducted at all sites every 3 weeks to detect breeding pairs and locate nests. We checked nests using mirror-poles or direct observation every 3 days during the nesting cycle to examine clutch size, cowbird parasitism status, hatch date, and nest success or failure (Martin et al. 1997).

Nestlings were measured and banded with a single Canadian Wildlife Service band and three-band color combination at 6 (Yellow-breasted Chat) or 7 (Gray Catbird) days of age. All nestlings were banded between 0700 and 0930 hrs PDT. Adults were captured using passive and target netting techniques. We banded adults with a three-band color combination and an aluminum Canadian Wildlife Service band. All fieldwork was in accordance with Simon Fraser University Animal Care permit 663B-03, bird banding permit 10365 CN, and Canadian Wildlife Service permit 59-03-0426. We used mist nets for up to one-half hr within territories at least 6 m from nests. Locally-recorded species-specific male songs were played for a maximum of 10 min to attract territorial males and females. We also placed passive nets within territories near known flight paths, but did not play tapes to capture some birds.

Daily nest success probability was estimated using maximum likelihood (Hensler and Nichols 1981, Rotella et al. 2000). A nest or female was considered successful if ≥1 Yellow-breasted Chat or Gray Catbird nestling fledged. Female fecundity was calculated as the mean number of fledglings per female per season. All females were single brooded. A second method of calculating fecundity, in which only successful nests were considered, was used for comparison with other studies. Percent parasitism was calculated as the percentage of all monitored nests that contained ≥1 Brown-headed Cowbird (*Molothrus ater*) egg or young at any point during the nesting cycle. Gray Catbirds were omitted from this portion of the study because they reject cowbird eggs.

Spot mapping was conducted for 20 Yellow-breasted Chat territories (5 observations per territory) in 2003. Territory visits were at least 3 days apart and observations were conducted for one-half hr during which all Yellow-breasted Chat sightings were recorded. Observations began 15 min after entering a territory. If a focal bird disappeared for more than 5 min, observations were excluded from the analysis. Time of observation, bird activity, location, perch height, and any other comments pertaining to bird behavior or surrounding ecology were recorded for all sightings. UTM locations were taken after the observation period based on maps and descriptive information recorded during the observation period. Territory size was calculated using Arcview GIS 3.1 area calculator.

We used STATISTICA (Statsoft 2000) for all statistical analysis. One-way analysis of variance (Sanders 1995) was used to test for differences in fecundity, clutch size, territory size, nest initiation, and hatching and fledging dates between years and patch type. Student's *t*-test was used to test for differences in nest success between years. There were between year differences in nest success rate, and the data are presented and analyzed by year. Results were considered significant at $P \leq 0.05$ and are presented as mean ± SD unless otherwise stated.

RESULTS

Twenty-five Yellow-breasted Chat nests were monitored in 2002 while 32 Yellow-breasted Chat nests and 34 Gray Catbird nests were monitored in 2003. Initiation of incubation began the third week of May and continued through 12 July in 2002–2003 for Yellow-breasted Chats and 4 June to 12 July 2003 for Gray Catbirds. Nest incubation, hatching, and

fledging dates were later in all years at isolated sites for Yellow-breasted Chats and Gray Catbirds (Table 1).

There were no significant differences in clutch size (3–6 eggs) or number of fledglings between years for Yellow-breasted Chats (Table 1). Percent parasitism ranged from 0 to 44% for Yellow-breasted Chat nests during 2002–2003. There was no difference in fecundity between parasitized and non-parasitized females (2.26 ± 1.53 and 1.71 ± 1.74 fledglings, respectively, $t = 1.01$, df = 51, $P = 0.282$). Fifty-seven percent of Yellow-breasted Chat nests monitored fledged at least one nestling in 2002–2003. Similarly, there was no significant difference in either year when clutch size and fecundity of Yellow-breasted Chat females breeding in isolated sites were compared with females in continuous tracts of habitat (Table 1).

Gray Catbird clutch size ranged from two to five and did not differ between isolated (3.67 ± 1.37) and continuous sites (3.76 ± 0.72). Female fecundity of Gray Catbirds in isolated (1.33 ± 1.75) and continuous (2.54 ± 1.65) sites did not differ ($t = 0.23$, df = 29, $P = 0.814$; $t = 1.84$, df = 32, $P = 0.075$; Table 1). There was no difference in nest success between habitats for Gray Catbird (Table 1).

Yellow-breasted Chat nest success rates differed between years and between continuous and isolated sites. In 2002, nest success was higher in continuous habitats than isolated habitats while in 2003 there was no difference between habitats (Table 1). Nest success was higher in isolated sites in 2003 than in isolated sites in 2002 (Table 1).

Mean Yellow-breasted Chat territory size in 2003 was 0.25 ± 0.24 ha ($n = 20$). No significant difference in territory size existed between habitat type (0.22 ± 0.28 for isolated sites, 0.29 ± 0.16 for continuous sites; $t = -0.56$, df = 18, $P = 0.584$). Territory size was not measured in 2002.

DISCUSSION

We found no evidence that fragmentation or isolation of riparian habitats in a western landscape reduced reproductive success or increased brood parasitism of Yellow-breasted Chats or Gray Catbirds. Percent parasitism, clutch size, and fecundity did not differ be-

TABLE 1. Reproductive characteristics of Yellow-breasted Chats and Gray Catbirds in isolated (< 2 ha) and continuous (> 15 ha) riparian habitat patches in the Okanagan Valley, British Columbia, Canada, 2002–2003. Superscript letters indicate significant differences ($P < 0.05$).

Habitat		Nests	Daily nest success	Percent parasitism	Clutch size	SD	Fecundity (fledglings/female)	SD	Incubation mean date	SD (days)	Hatch mean date	SD (days)	Fledging mean date	SD (days)
Yellow-breasted Chat														
Isolated	2002	9	0.926[ac]	44	3.75	0.46	1.78	1.79	20 Jun[d]	11.79	30 Jun[g]	11.08	18 Jul[h]	5.32
	2003	8	0.950[a]	0	3.57	0.53	0.87	0.89	21 Jun[f]	15.4	3 Jul	12.58	13 Jul	13.25
Continuous	2002	16	1.000[bc]	12	3.47	1.37	1.78	2.07	7 Jun[d]	8.61	18 Jun[g]	8.92	28 Jul[h]	8.91
	2003	24	0.951[b]	38	3.37	0.92	1.67	0.92	15 Jun[f]	13.87	23 Jun	12.45	4 Jul	15.59
Gray Catbird														
Isolated	2003	6	0.916	0	3.67	1.37	1.33	1.75	27 Jun	7.94	9 Jul	9.74	23 Jul	8.72
Continuous	2003	28	0.914	0	3.76	0.72	2.54	1.65	16 Jun	10.96	28 Jun	11.34	9 Jul	11.41

tween isolated and continuous habitat patches for either species. However, delayed incubation at isolated sites by both species suggests continuous sites may be preferred habitat, filling up sooner and causing late arrivals to breed elsewhere (Fretwell and Lucas 1970). Differences between years may reflect local environmental fluctuations. More breeding pairs were detected in 2003 but decreased nest success in 2002 may be indicative of overall decreased habitat quality in that year.

Both Gray Catbirds and Yellow-breasted Chats had similar patterns of productivity and nest success between habitats in 2003. When compared to other Yellow-breasted Chat populations breeding at the core of their range (Thompson and Nolan 1973, Schadd and Ritchison 1998, Rickets and Ritchison 2000), the Okanagan population had similar levels of productivity.

Yellow-breasted Chat territory size (0.25 ha) in the Okanagan Valley was smaller than reported for mid and high-density southern Yellow-breasted Chat populations (0.5–1.0 ha, Dennis 1958; 1.24 ha, Thompson and Nolan 1973). Clutch size in the Okanagan (3.5 eggs/nest) was the same as that of more southerly populations (3.5 eggs/nest; Thompson and Nolan 1973). Overall fecundity (2.86 young/successful nest) was within the range of that reported for southeastern populations (3.25 young/successful nest, Schadd and Ritchison 1998; 2.3–2.9 young/successful parasitized and non-parasitized nests, Whitehead et al. 2000). The percentage of nests that were successful (57%) was midrange when compared to other studies (22.5%, Thompson and Nolan 1973; 84.2%, Schadd and Ritchison 1998; 45%, Rickets and Ritchison 2000). The consistency of fecundity values between the Okanagan Valley and southern populations indicates conditions at the fringe of this species range are not negatively affecting productivity.

Despite the narrow range in latitude for all sites monitored, later nest initiation and fledging dates were found in isolated riparian patches. Consequently, we expected birds breeding in this habitat to have reduced nest success or fecundity. The absence of a significant difference in fecundity between isolated riparian patches and large tracts of habitat indicates Yellow-breasted Chats and Gray Catbirds can successfully reproduce in a highly fragmented environment. Settlement patterns in this study suggest that, although continuous and isolated sites may be comparable in quality, continuous tracts may be preferred breeding locations and have the capability to support higher breeding densities. Alternatively, isolated patches may lag behind continuous patches in resource availability for reproduction. It is also possible that continuous patches may cater to the semi-colonial nature thought to be a characteristic of Yellow-breasted Chats (Griscom 1923).

The current level of riparian habitat fragmentation does not appear to be a limiting factor for either Yellow-breasted Chat or Gray Catbird populations in the Okanagan Valley, British Columbia. Parameters for Yellow-breasted Chat breeding at the northwest extent of their range are comparable to more southerly populations, suggesting that conditions at the edge of the species' range do not reduce productivity. The smaller territory size of Yellow-breasted Chats in the Okanagan Valley may suggest a higher concentration of breeding resources.

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